Annex 001
To Memorandum of Agreement
Between
DOT/FAA and NASA Concerning
Wake Turbulence Research and Development

MITRE/CAASD Support for Wake Vortex Avoidance System (WVAS)
Planning and Development

Task Statement: Support of the Wake Turbulence Research Program – Phase II and Phase III

Period of Performance:
4/1/2004 – 9/30/2004
(It is expected that this work will be continued by subsequent task orders.)

Funding: It is expected that the funding for this task will be provided in one installment of $600,000.

General Description of the Task:
FAA and NASA have agreed to a combined effort to apply wake turbulence knowledge, sensor technology, procedure development expertise and decision support tool design experience to separate aircraft from the wake hazard in a manner that accommodates the need for higher airport arrival and departure rates and the imperative that the national airspace system (NAS) safety is not decreased.

The requested support is in the following three areas:
1. Benefits and Development Risk Analyses
2. Development of wake vortex avoidance system (WVAS) Concept of Operations
3. Program Evolution Recommendations

1. Benefit and Development Risk Analyses:
The contractor shall revise and extend the initial WVAS procedures and benefits analyses (provided by the MITRE Corporation Center for Advanced Aviation Systems Development (CAASD) under FY-03 funding) to include development risks, concepts of operation developed under task 2 above, and more detailed consideration of potential WVAS components and procedures.

The WVAS program aims at the development and demonstration of wake vortex related technologies that promise significant benefits in the NAS, and that articulate a clear path to implementation to actually realize these potential gains. The demonstration of NASA's Aircraft Vortex-Spacing System (AVOSS) technologies in FY02 and the ensuing close partnership with the FAA through the research management plan (RMP) has re-enforced the need to consider a complete spectrum of potential air traffic control (ATC) procedures that may provide benefit from AVOSS-like technologies and their derivatives in the NAS. Work

conducted by MITRE/CAASD for NASA in FY-03 showed that many capabilities and procedures could be conceived that utilize one or more WVAS technologies to, potentially, provide benefits beyond the near-term procedural enhancements currently being pursued by the FAA. The spectrum of possibilities is considerably widened when other enabling technologies such as area navigation (RNAV) and required navigation performance (RNP), automatic dependent surveillance broadcast (ADS-B), data link, controller tools, etc. are also considered. Each of these capabilities requires a different degree of technological sophistication, have a different prognosis for development, demonstration & deployment, and promise a different degree of benefit. The WVAS program must assess the relative merits of these technologies to support WVAS concepts with respect to the degree of benefit, potential risks, and outlook for development and operational acceptance by the FAA in order to focus-in on the most promising avenues of research and development.

The framework for WVAS benefits analysis, developed by MITRE/CAASD in FY-03, shall be revised and extended to include the potential benefits of new technologies incorporated into WVAS concepts of operation developed under Task 2. The revised analysis shall address the risks and benefits of dynamically changing the wake separation minimums in the terminal area; taking in the consideration how a changing airport acceptance rate (caused by the changing wake separation criteria) will impact the predictability and flexibility of the NAS. The benefits analysis shall also incorporate updated models of wake transport and decay and "lessons learned" from wake turbulence data analyses at St. Louis, San Francisco and other data collection efforts, as these data become available. It is understood that information from models updated for application to an operational environment as well as relationships of weather factors to wake turbulence trajectory and decay, will be provided by NASA to the contractor to support these analyses. Since current wake models are being updated to reflect new information, the contractor shall express benefits as relative values rather than absolutes, which should facilitate the down-select process.

The contractor shall consider factors affecting development and deployment of systems in the NAS and develop recommendations for the most promising (cost, benefit, timeframe to first benefit) technology/procedure alternative(s) and associated proposal(s) for integrating the technology and procedures into the NAS infrastructure and operational environment. The contractor shall consider certification and authorization issues, and other factors relevant to development and deployment of a technology/procedure alternative.

It is expected that this work will be continued beyond FY-04 under a subsequent Industrial Funding Task Request.

Deliverables:

(1) The contractor shall provide a final report to NASA and the FAA (in mutually agreeable electronic and hardcopy formats) describing relative WVAS benefits and development risk analyses performed under this SOW. (8/31/2004)
(2) The contractor shall provide a brief monthly report to NASA describing the status of Task 1. The report shall include any known problems affecting successful completion of Task 1, approximate human resources allocated to the task, and any contractor products (documents, reports, etc.) delivered under this SOW. The report may encompass activities associated with all three requested tasks. Submission solely by electronic means is acceptable.

2. Development of WVAS Concept of Operations:

Based on the emerging results from the task 1 benefits and development risk assessment and other studies, the contractor shall develop recommendations for the most promising (cost, benefit, time to first benefit) technology/procedure alternative(s) and associated proposal(s) for integrating the technology and procedures into the NAS infrastructure and operational environment. This work shall be accomplished as support for and participation in a government/industry/ academia stakeholder's workgroup that has been formed to oversee the development of potential WVAS concepts of operation and the selection of the most promising alternative for the aviation community. The contractor shall consider certification and authorization issues, and other factors relevant to development and deployment of a technology/procedure alternative.

The success of WVAS requires that a concept of operations be developed for the most promising procedures and capabilities that reflect the reality of the deployment environment and operational needs of the users. The purpose of this task is to formalize MITRE/CAASD's participation in the development of one or more WVAS concepts of operation that have the greatest chance of development and the most benefit. NASA, in conjunction with the FAA, has convened government/industry/ academia stakeholder's workgroup that will oversee the development of these concepts of operation. The contractor shall participate in this workgroup and provide specific input regarding operational considerations and associated development and deployment risks, and approaches to mitigating such risks. The contractor shall consider certification and authorization issues, and other factors relevant to systems development and deployment including technological risks, and program strategies for mitigating them. Based on the benefits analyses conducted to date, and the analysis of operational, technological, and certification issues, the contractor shall provide recommendations regarding the potential of proposed WVAS concepts with respect to development and deployment risks and recommend promising approaches. In particular, the contractor shall provide specific inputs regarding concepts with the greatest potential of deployment in the 7 to 10 year time frame as candidates for capabilities to follow those currently being pursued by the FAA. The contractor shall develop an initial set of recommendations for developing controller tools in support of the WVAS concept, as part of this task.

It is expected that this work will be continued by a subsequent task order.

Deliverables:

(1) The contractor shall provide preliminary analyses, white papers and descriptions to support the government/industry/academia Conops workgroup, as appropriate.

(2) The contractor shall provide an interim set of recommendations for promising WakeVAS procedures. (3/31/2004)

(3) The contractor shall provide a brief monthly report to NASA describing the status of Task 2. The report shall include any known problems affecting successful completion of Task 2, approximate human resources allocated to the task, and any contractor products (documents, reports, etc.) delivered under this SOW. The report may encompass activities associated with all three requested tasks. Submission solely by electronic means is acceptable.

3. Program Evolution Recommendations:
The contractor shall assist NASA in planning Phase II and Phase III portions of the NASA wake turbulence research program. The contractor shall provide recommendations for revising/enhancing NASA's research program plans based on the contractor's expertise in developing and deploying operational systems in the NAS. The contractor recommendations shall incorporate results from the benefits assessment and concept of operations analyses as they become available.

Deliverables:

(1) The contractor shall provide recommendations for revising/enhancing NASA's wake turbulence research program, as appropriate.

(2) The contractor shall provide a final summary to NASA (in mutually agreeable electronic and hardcopy formats) describing the Task 3 activities supported under this SOW. (9/15/2004)

Resource estimates for FY-04: $600,000

APPROVED:

DOT/Federal Aviation Administration

George C. Greene, Manager
FAA R&D Field Office (Langley)

4/15/04
Date

National Aeronautics and Space Administration

Wayne H. Bryant, Manager
Wake Vortex Advisory System and Virtual Airspace Modeling System

4/15/04
Date